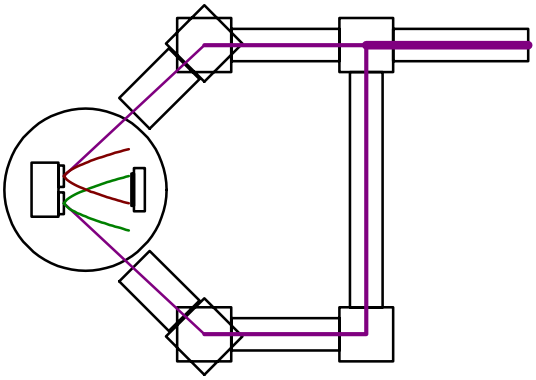
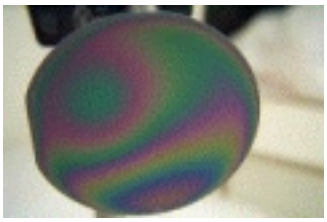
Dielectric oxide thin films

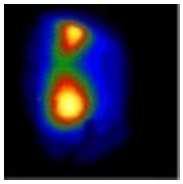
- Critical Issues
  - The explosive growth of the wireless communications industry has spurred a demand for improved thin film materials with higher dielectric constant and lower loss. Detailed information on the effect of processing and composition on the dielectric properties of candidate materials is needed to identify promising materials for the next generation of wireless devices.
- Research Strategy
  - The approach is to: 1) develop rapid prototyping tools for the fabrication and characterization of dielectric oxide thin film libraries; and 2) utilize these tools to generate processing/composition/dielectric property maps for materials systems of interest for wireless communications. The initial dielectric material selected for these studies is $BaTiO_3$ - $SrTiO_3$, a leading candidate for voltage tunable devices.
- Research Highlights
  - Thin film $BaTiO_3$ - $SrTiO_3$ (BT-ST) libraries of varying composition have been fabricated by a novel dual-beam, dual-target pulsed laser deposition process. Interaction of the two laser plumes results in a film of continuously variable composition, as confirmed by electron microprobe analysis measurements in CSTL *(NIST Chemical Science and Technology Laboratory)*. Film thicknesses have been mapped by a semi-automated reflectance mode spectrophotometry technique. The dielectric properties of the libraries will be measured by a high-throughput scanning evanescent microwave microscope recently developed in CSTL. The film deposition process is broadly applicable to other ceramic materials as well as metal and metal/ceramic composites.



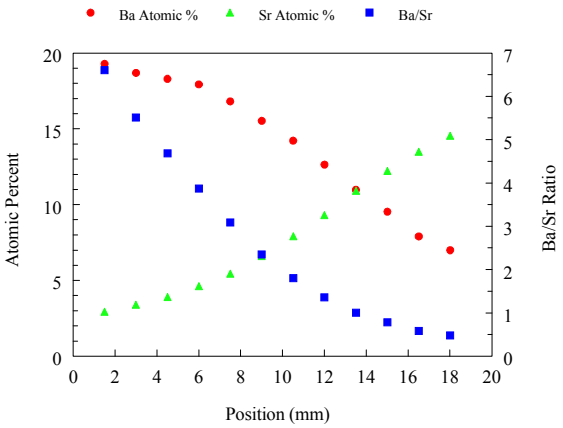
Dual-beam, dual-target system.



BT-ST library film on a 2” Si wafer



False color image of dual-beam deposition process



Composition profile of a BT-ST library film

For more information ...

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